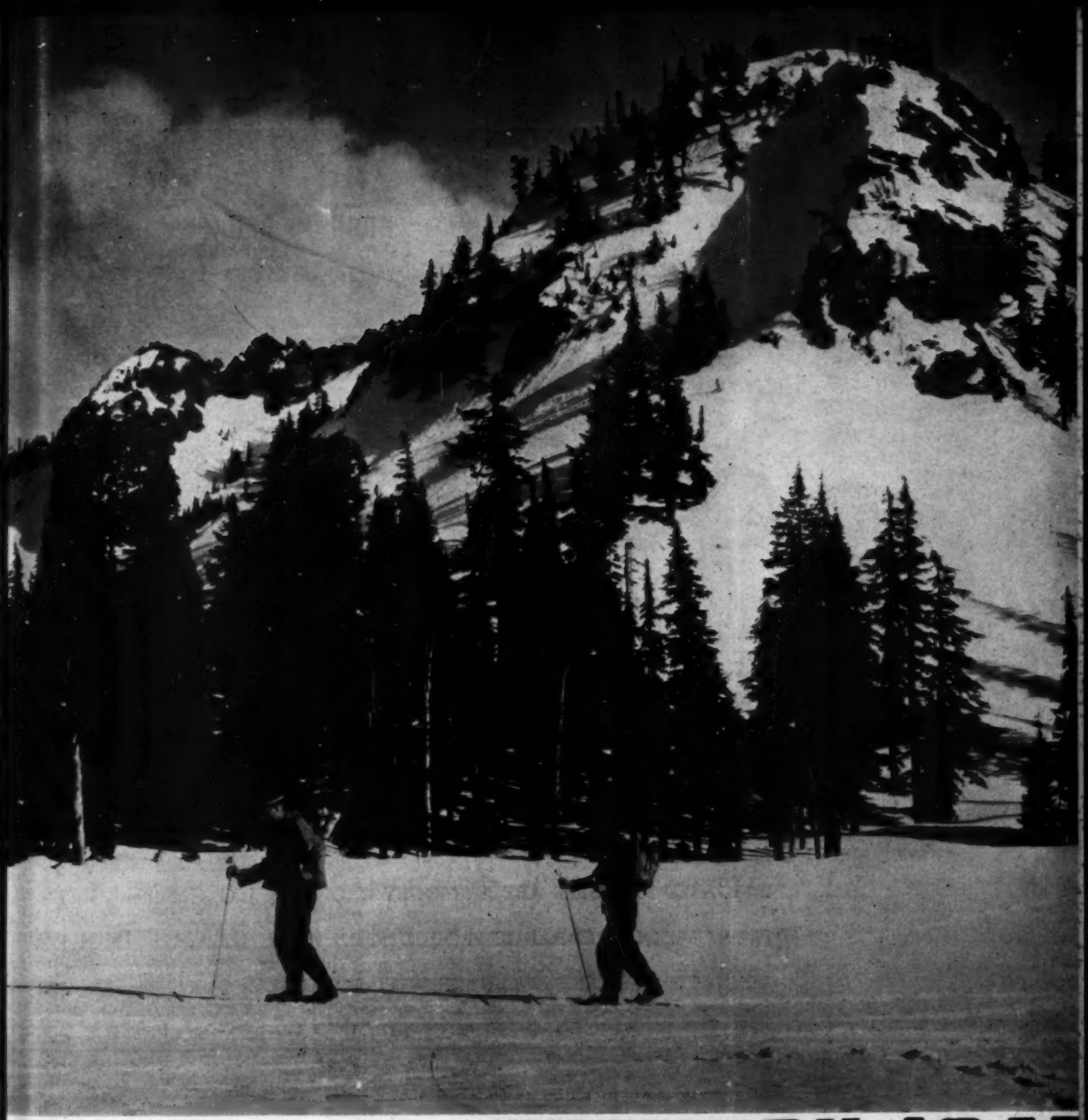

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SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

ITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D.

SOIL CONSERVATION

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WELLINGTON BRINK EDITOR

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Front Cover: Returning from the Seven Lakes Snow Course with sampling equipment and notebooks crammed with data that mean dollars and cents to agriculturists and power companies in the valleys far below. Photographer: Jack G. James.

SOIL CONSERVATION is *issued monthly by* SOIL CONSERVATION SERVICE of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business, with the approval of the Director of the Budget. SOIL CONSERVATION seeks to supply to workers of the Department of Agriculture engaged in soil conservation activities, information of special help to them in the performance of their duties. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 10 cents a copy, or by subscription at the rate of $1.00 per year, domestic; $1.50 per year, foreign. Postage stamps, will not be accepted in payment.

The Tall Grass is Coming Back

By EARL R. BAYS

Cows grazing on crested wheatgrass pasture of Earl Bays. These animals have ample green forage between time cheat grass matures and mountain pastures are ready.

Old-timers tell me that, back in the early days, the Glade Park country was a land of tall grass. In fact, before it was named Glade Park it was known as "the big grass country." Today, the grass has disappeared and has been replaced by sagebrush, which offers little or no food for cattle except in winter, and even then the use of supplemental concentrates is necessary. Apparently grass has gone from this area as a result of homesteading and too heavy summer use. The first use of this land was by the "S-Cross" and Seibert cattle companies, who drifted to the summer range of Pinion Mesa at an elevation of 8,500 to 10,000 feet, and came back for winter grazing in the Glade Park area.

Charles V. Eckman and I came from north-central Kansas after the first World War, in 1921, and took up a homestead on the west end of Glade Park. At that time there were 12 or more families living in this community, and our West End School had an enrollment of 23 pupils. Farming, with some livestock operation, was practiced by most of the settlers. Sage hens were quite plentiful and remained so until the season opened a few years ago.

Then the dry years came, and some of the families started to "pull up stakes" and leave the country. The area certainly has changed in the 20-odd years since I came here. The sage hens have practically disappeared, the tall grass is gone on most of the area, and of the 12 families here in the West End, only four are left.

After the First World War, a grateful government passed out dryland homesteads to returning veterans. For a few years, during a favorable weather cycle, many of these homesteaders made good crops, for the virgin soil had been storing up fertility through the centuries. Then came drought, dust, and depression. Personal tragedies that grew out of this last hopeful wave of pioneering are familiar to all Westerners. However, not all of these farmers were downed by failure. This is the story of Earl R. Bays of Mesa County, Colorado, one of the veterans who "stuck it out" and made a success because he learned to work with nature, not against her. In his own words, he tells how the plow and heavy grazing ruined a "tall grass country," and how tall grass is coming back again.

Several years ago I could see that cash cropping was not the thing for the Glade Park area. I had a few head of livestock and tried to raise winter feed by farming. Occasionally we would hit a good crop year, but several years it has cost me $40 a ton to raise the feed. You can't make money that way, so about the time I was figuring out a new way of farming, the Soil Conservation Service came along.

We organized a Soil Conservation District up here in 1940, and with the help and advice of technicians assigned to the district, I put in 50 acres of crested wheat grass. I planted it in the fall, and the next spring I was quite disappointed with the small showing. The next year the stand was better, and the third year a favorable growing season brought it really into its own. I cut a hay crop of a ton and a half to the acre, besides getting a good fall pasture.

Before cutting the hay crop, representatives of the Soil Conservation Service and I took a test of three plots. Plot No. 1, consisting of crested wheatgrass, brome, and some volunteer rye, was in a low swale or draw that flooded. It was not a fair test, but we wanted to see what could be expected under the most favorable conditions. Plot No. 2, consisting of straight crested wheat, was a little lighter in stand but over 3 feet high. Plot No. 3, also straight crested wheat ran heavier but not so tall. The following summary shows the green weight, the percentage of shrinkage, and the final weight of thoroughly dried hay per acre.

Plot	Green weight	Percent shrinkage	Dry weight
1	12,380	63	4,687
2	8,476	58.5	3,500
3	6,250	57	2,687

Considerable area, especially in the sagebrush country, has cheat or June grass as its principal forage. Since there is a gap between the time cheat grass is available and the time that summer pasture is ready for use in the higher country, the stock usually lost a little ground. Crested wheat grass seemed to be the most practical feed to fill this gap.

Shortly after revising my farming operations I bought another 400 acres that had about 70 acres of cleared land, and put that into crested wheat. It was so satisfactory that I purchased another 800 acres, 300 of which are broken. The former owner had been farming quite extensively, with varied success. At the time I started my grass farming, several other dryland farmers rather scoffed at the idea of using cleared land to grow grass. At present, some of those farmers are gone, and my cows are running on grass I planted on lands they previously farmed.

I drilled in crested wheat on this entire acreage of cleared land. Under favorable conditions, it will be a great help in spring and winter feeding. Last spring, I took off 200 acres or more of sagebrush which was seeded last fall to a mixture of crested wheat, Western wheat, sand dropseed, and sideoats grama.

Crested wheat seems to be the most satisfactory grass for this semi-arid area, because it has the peculiar ability to go dormant in a drouth and simply wait for rain to come. The reports from various experiment stations over several states indicate that after crested wheat has survived the first eight months, there is no record of a field being lost from drouth, or pests.

Crested wheat will furnish excellent fall pasture provided there is sufficient moisture in the late summer and early fall. Staying green under the snow all winter, it provided one of the earliest spring feeds available.

Wind erosion on cultivated land has been quite bad at times. The grass has stopped this erosion, the washes below the fields are starting to heal over, and in time will fill up.

My experience with crested wheatgrass has been entirely satisfactory. If fields of this grass are not pastured in the spring, the growth should be at least knee-high and, at times, three feet high, with a good seed crop—depending, of course, on the moisture.

The crested wheat pastures prevent livestock from losing weight during the period between maturity of cheat grass and availability of mountain pasture. I find that "booming" cows and calves during this period, instead of letting them fall behind, makes a wonderful difference in the fall, both in the weight of calves and in the flesh the cows are carrying to go into the winter season. April and May calves so pastured will weigh 425 pounds or better by the first of November. That is a good weight for spring calves in any man's country.

The Soil Conservation Service technicians inform me that approximately 4,400 acres of former dry farming land in this area have been seeded to crested wheatgrass. It is my opinion that crested wheatgrass is here to stay in the Glade Park country.

KUDZU MOVES NORTH

The SCS nursery at Beltsville, Md., will plant several acres of kudzu to provide crowns for trial north of Mason and Dixon's line.

Sagebrush land was brought into production here by relocating the irrigation laterals. A good crop of hay is now produced, as an addition to the bed base of a large livestock ranch. Part of the original meadow has become infested with willows. It will have to be cleared and seeded to an improved grass-legume mixture.

IRRIGATED MOUNTAIN MEADOWS

By WILKIE COLLINS, JR.

Last year a Wyoming rancher harvested the hay from a demonstrational seeding of tame grasses and legumes on some of the poorest of his irrigated land.

The results gave him food for thought. The tame grass mixture yielded twice as much per acre as his native irrigated meadows on better land. This happened even though the seeded area had been irrigated less, and had been very heavily grazed by the cattle before they were moved to the range about June 1.

Now this rancher, C. C. Feltner, near Pinedale, has begun the establishment of tame grass mixtures on his meadow lands. And equally important, he is changing his irrigation practices with help from the Pinedale Soil Conservation District and Soil Conservation Service technicians. His goal: More and better feed supplies and better pasture for his livestock when they are not on the range.

There are thousands like Mr. Feltner in the Northern Great Plains, ranchers who depend on irrigation for hay crops but have seen hay yields fall off and water requirements rise. Constant irrigation from spring until shortly before haying time has forced out the higher yielding grasses and encouraged the invasion of coarse grasses, sedges and rushes. Failure to use fertilizer has also contributed to the decline.

EDITOR'S NOTE.—The author is chief, regional agronomy division, Soil Conservation Service, Lincoln, Neb.

It is among these people that nearly all accomplishments in improving irrigated pastures and meadows have been attained in this region. Comparative production of the same sort of crop is easy to understand. In the intensively farmed areas, on the other hand, grass for irrigated pasture or hay production comes into direct land-use competition with specialty crops such as sugar beets and beans. Nevertheless, assistance in improving and establishing irrigated meadows and pastures is one of the big jobs in the Northern Great Plains.

The job in the livestock ranch country is fourfold: Introduction of grasses and legumes that will produce more hay tonnage per acre and more pasture; mechanical improvements in the irrigation system so that the ranchers can control and measure the irrigation water applied; introduction of better irrigation practices to replace the custom of constant irrigation from spring until shortly before haying time; and development of management plans. What is done on one square mile of such hayland affects the welfare of establishments aggregating many times that acreage, through improving the feed base.

Plants growing in those long over-irrigated meadows are those which require excessive amounts of water. While yields of one-half or three-quarters of a ton of hay per acre are more nearly the rule than the exception, any reduction in the amounts of water applied will reduce the yields

still further. Therefore, renovation must be "grown from the ground up." That is, plowing up the old grasses and seeding new mixtures.

The practice is to plow up an old meadow and seed it to small grain, usually oats, for a couple of years in order to clean up the land. Leveling is done where necessary and practical, and manure, which heretofore has been largely wasted on the livestock ranches, is applied. Then mixtures of adapted grasses and legumes, which produce a high-protein feed, are seeded.

To date, local preference rather than proved superiority over other mixtures governs selections. A bromegrass-alfalfa mixture is more generally approved where it is adapted, because it appears to be a good yielder and very palatable to livestock both as hay and pasture. Mammoth red, alsike, white dutch and strawberry clovers are frequently used, while among the grasses are found tall oatgrass, meadow fescue, orchard grass, slender wheatgrass, perennial rye grass, crested wheatgrass timothy, redtop, and scotchgrass.

Joe Budd, Big Piney, Wyo. operating an old, widely known ranch which his father established, is one of the ranchers well along with the renovation of his irrigated meadows. His experiences cover rather well the whole problem of renovation —the benefits of controlling and measuring water, better grasses and legumes and the need for a job done from-the-ground-up. Formerly short of water as a usual thing, Budd figures now on bringing about 25 percent more land under irrigation as a result of water savings.

Whereas the usual yield of native irrigated meadows ranged from a half-ton to a ton per acre in 1944, which was pretty good, he reported that his improved meadows produced 1½ to 2 tons per acre, depending on the quality of the soil. In contrast to the flooding system generally used, Budd's improved meadows are irrigated systematically, water turned on for 3 days, then off for 5. Irrigation water is controlled and measured by turnout boxes, and laterals are located so as to get quick, even distribution of the water.

"I have found, too, that one just throws his money away when he tries to seed the improved mixtures in native irrigated meadows," Budd remarked. "I tried it. Those native grasses take a lot of water to produce hay. The tame grasses and legumes can't stand that much, so they just won't grow."

He went on to explain that he still has some native meadow that he hasn't renovated yet. This gives him a direct comparison of how the native grass meadow took much more water, but produced less hay.

A development of another sort is the Reed Dayton ranch, only 4 miles from Cokeville, Wyo., where leveling of the land is not practical. Instead, water has to be led to the higher places and distributed carefully so as to avoid ponding in the lower areas. The Soil Conservation Service technicians designed an irrigation system that places the water at the right places. It is carried across the low places on levees.

This 640-acre ranch, of which some 40 or 50 acres is still unirrigated and covered with sagebrush, is producing some wheat as a cash crop, as well as pasture and feed for 50 dairy cows. A good part of the ranch has already been seeded to a mixture of alfalfa, sweet clover, bromegrass and crested wheatgrass. One oat field was also seeded to the grass mixture along with the crop last spring.

On the basis of his experience with the irrigated grass and legume mixture for pasture and hay production, Dayton is contemplating converting to a 150- to 200-head beef outfit, when he gets through developing his irrigation system and grass seeding program. His pasture experience indicates that he has set his sights conservatively.

If he does convert, he will be maintaining a livestock enterprise which ordinarily in that area would be thought of as requiring native range and native grass irrigated meadow totaling 3,500 to 4,000 acres.

In the same way, the livestock growers are learning the superiority of grass-legume mixtures for pasture. It is customary for the ranchers to graze their hay meadows in fall after the stock is brought in from the range, and those who have had experience report their cattle maintain their flesh in fine shape on such pasture.

Howard Bleick, 18 miles west of Thompsen Falls, Montana, has found that putting his milk cows on an irrigated mixture of bromegrass, clover and meadow fescue resulted in 25 percent more cream production. This grazing is at a considerably higher rate than his native irrigated pasture can stand. He has found, too, that it pays to keep cattle off a pasture during the time it is being irrigated, because trampling of grass while the ground is wet causes too much damage to the plants. He's planning on more grass-legume pasture.

Tests at the Wyoming experiment farm are comparing the results of grain feeding yearling steers on irrigated pastures and lot feeding. Four

recommended mixtures are used in the irrigated grass plots. The results thus far indicate that under average conditions the net income from grain feeding in irrigated pasture compares favorably with the income from intensively cultivated crops. This is true with most grass-legume mixtures under proper irrigation and management.

Farmers and ranchers frequently ask, "What is the value of an irrigated pasture?" They want to know how the income from an irrigated pasture compares with the income from other irrigated crops. This question is hard to answer as adequate information on the economical value of irrigated pastures is not available. Naturally, the value of an irrigated pasture varies with the productivity of the soil, the kind of pasture, the way it is irrigated and managed, and the price of beef, butterfat and wool, and the quality of livestock grazed. There are examples of farmers who keep records and evaluate good irrigated pastures at from $25 to $75 per acre annually. One feeder in western Nebraska estimates $76 an acre as the value of his irrigated pastures for one year. Another gives $55 as the value of his pasture. One of the experiment stations has produced 16 cow months of grazing per acre from a good irrigated pasture.

Tom Coleman, one of the district supervisors of the Popo Agie Soil Conservation District at Lander, Wyo., cuts 2 tons of high quality hay per acre and then subjects his irrigated pasture to grazing. From this is returned $35 worth of butterfat per acre. With hay worth $10 a ton, a value is realized of approximately $55 per acre from the irrigated grass-legume mixture used in combination for hay and pasture. Results have been so satisfactory that Mr. Coleman is seeding all of his irrigated land to grass-legume mixture for hay and grazing purposes.

In a recent trip through Wyoming, seven of the soil conservation districts located in irrigated areas were visited and several district supervisors, farmers, ranchers, county agents, and Soil Conservation Service technicians were asked as to the value of irrigated pastures. Their general opinion was that the economic returns from an adapted and well managed irrigated pasture is equivalent to or greater than the returns from other crops produced under irrigation on similar soil types.

Farmers are recognizing more and more the necessity of livestock manures in maintaining the fertility of irrigated land. With livestock so es-

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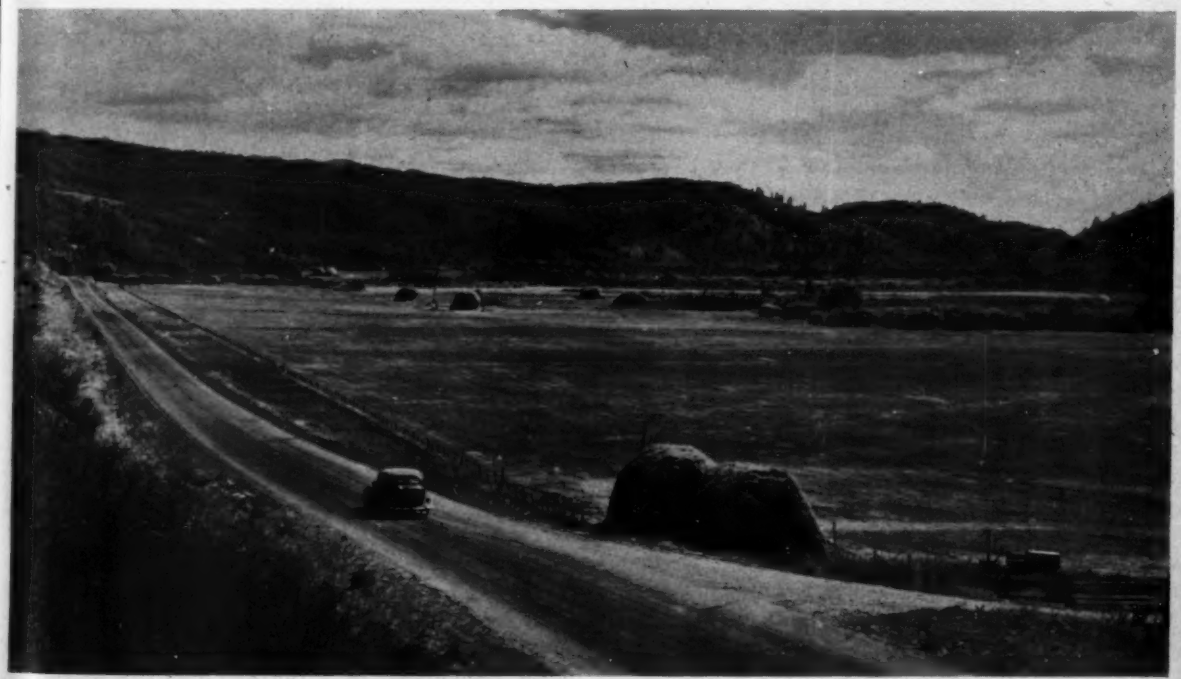

Much of this irrigated meadow was covered with willows. It was cleared, planted first to small grain for a couple of years, then to tame grass and legumes for hay production and pasture. Technicians of the Soil Conservation Service designed the irrigation system so that distribution of water can be controlled. It provides hay and pasture for a dairy farm.

Take Care of the Range and the Profits Take Care of Themselves

By W. T. WHITE

John Wright in the Pahranagat Valley Soil Conservation District in southeastern Nevada has been helped by soil conservation practices to build up a thriving cattle feeding business in addition to running his own herd.

Conservation practices bid fair to play a progressively important role on a third of a billion acres of privately owned range land in five states of the Pacific northwest.

Indicative of the role open to improved range land-use and management practices is the increased war-time beef production from soil conserving practices. A survey reports a 41 percent increase from such practices on farms of the region. Any post-war let-up in demands for meat and wool will in no wise lessen the importance of good range pasture and its proper conservation use for efficient and economical operation.

Forage types vary from the perennial bunchgrasses of the Pacific Northwest (Idaho, Oregon and Washington), such as beardless and bluebunch wheatgrass, Idaho fescue and big bluegrass, to the California annuals like Alfilaria, bur clover and annual bromes such as soft ches. Such perennials as California oatgrass and purple needlegrass also are found in California, just as is the annual, cheatgrass, which supplies forage on many northwestern ranges. Desert-type grasses and even some of the prairie grasses, like the gramas, predominate in Nevada.

Seasons of use also differ somewhat within the Pacific Coast region: Whereas the conventional spring, summer and fall grazing with winter feeding prevails in the eastern Washington and Oregon and southern Idaho range areas, so-called winter grazing is common in the California areas of annual vegetation. Late fall and mid-winter rains,

EDITOR'S NOTE. — The author is regional chief of the range division, Soil Conservation Service, Pacific Coast Region 7, Portland, Ore.

Pacific Coast ranchers like their stockwater ponds. This one is on the Charles Petrie ranch in the Upper Thomas Creek erosion control demonstration project west of Corning, Cal.

in other words, bring on annual grass growth, and the stock may be turned on it after the first of the year. Then the first hot summer weather dries up the annual forage, necessitating movement to mountain summer range where that is available, or to supplemental pasture and feed. Thus, fall

pasturing of stubble and other aftermath also becomes popular. Nevada, though primarily in the regular spring-summer-fall grazing belt, also has considerable "winter grazing," on the desert ranges.

Regardless of these intra-regional differences in forage types and seasons of use, the special problems posed by some of them actually serve only to emphasize the basic place in the range conservation program of so-called standard practices: Stocking within carrying capacity; deferred and rotation grazing; stockwater development, salting and other devices to assure even distribution; growing supplemental feed and keeping the proper balance between range forage and such supplemental feed supplies. Local conditions dictate the emphasis.

It is agreed that range forage and good pasturage provide the cheapest livestock gains. Consequently, as profits depend to a large extent upon the kind and quality of feed provided, range conservation means cheaper gains on range livestock. Our depleted ranges have broken down under excessive and uncontrolled grazing use and accordingly are less productive than they once were. Fortunately, most of the injured ranges in the Pacific Coast states still retain enough of the best forage plants to permit them to be built back to better and sustained production. This is contingent on the adoption of an extensive improvement program. Through soil conservation districts, especially, many of them, including some of the largest cattle and sheep operators in the country, already are doing this very thing.

All our range today is limited or fenced, and operators must depend upon a continued high yield from their allotted or fenced areas, whether leased or owned. The major objective, then, is currently to harvest by grazing only that portion of the important forage plants which will allow the desired plants to maintain full vigor for maximum yield and effectively compete with the less desirable plants. Accurate practical knowledge of the effects of grazing upon the important forage plants thus becomes the key to sound management. And the operator cannot apply sound management if, because of a lack of feed or spring pasture, let us say, he is forced onto the range too early in the season, before the key plants attain sufficient growth to produce normal root and top growth and become able to withstand grazing without serious loss of vigor.

Similarly, when too large a proportion of the season's growth is removed by grazing, the desirable plants fail to mature seed, and insufficient residues are left to protect the soil and plant roots from the injurious effects of low temperatures and beating rain. In the western states, characterized by wet winters and dry summers, severe seasonal overgrazing may be expected to subject the range to excessive run-off, low moisture absorption by the soil, soil washing, soil blowing, exposure of roots and crowns of forage plants to frost injury and dessication, resulting in delayed starting or retarded growth of the next season's forage crop.

Representative of the range conservation practices that Pacific Coast ranchers have found to be profitable are these:

1. Deferred spring use to allow key forage plants to attain full vigor and mature seed.
2. Shifting from sheep to cattle or from cattle to sheep for a time, or arranging to graze sheep and cattle in alternate years.
3. Grazing no more than the proper proportion of the best forage plants.
4. Leaving some plant residues each year to accumulate and to protect the topsoil.
5. Delaying "turnout" of stock on the range in the spring until the soil has become firm.
6. Reducing excessive travel and trailing by fencing, and locating water supplies and salt stations so as to cut down travel.
7. Using movable salt stations to encourage stock to go into under-utilized areas of the range and, by the same token, removing salt from areas already properly grazed or over grazed.
8. Marketing sale stock promptly before they begin to shrink.
9. Culling inferior animals rigidly, leaving the good, thrifty animals that produce more gains on the same feed than do unthrifty, inferior stock.

Many other measures are also in effect, including plant control, contour furrowing and water spreading, planting temporary pastures, and fire protection. Certain local conditions also lead to developing Harding grass and burnet for dryland pasture to supplement California's annual forage, and to encouraging improved irrigated pastures and haylands on headquarters ranches in Nevada, where most of the range proper is public domain. Growing of more winter feed is the main need on private lands in districts and elsewhere.

Whatever the specific practices, the objective is to keep the optimum amount of forage cover on the range, both as the most profitable continuing crop and to protect the soil against erosion and conserve the moisture for plant growth. For the perennial grasses, the aim in the Pacific Coast states

is to keep stock off in the spring until the new growth is 4 to 6 inches tall and, similarly, to leave at least 4 inches of growth to go through the winter. For the California annual-type vegetation, the general recommendation is to leave not less than 400 to 500 pounds of dry material.

Though herd or flock adjustment to fit such a pattern of forage conservation and available feed supplies sometimes comes hard, the experiences of progressive stockmen are directing attention to the fact that it is the amount of meat and wool that goes to market, and the money in the bank, that measure their success, not the numbers of cattle or sheep on the ranges. Steve Adams, big operator south of Lava Hot Springs, Idaho, found as a result of his range management plan developed through the Portneuf Soil Conservation District that one band of sheep was more profitable than two bands of the same size which had been grazed on the same range.

Examples are multiple that range conservation pays. In the Escondido Soil Conservation District in San Diego County, Cal., to pick at random, the district's pasture and permanent hay programs alone were credited with adding 100,000 pounds of beef to the war stockpiles the last fiscal year. District Director George E. Satterlee attributed half of the valley's 5-fold increase in cattle since the war to the war demands and "the other 50 percent to our pasture and conservation program."

In eastern Nevada's big White Pine Soil Conservation District—the biggest anywhere—the all-important livestock business depends largely upon public range supplemented by winter feed, with efficient use of irrigation water vital to its production. District Treasurer George N. Swallow, big local operator, said that district facilities had "enabled cooperators to increase production from 30 to 60 percent, and at the same time cut materially the unit cost of production." John Wright in the Pahranagat Valley district in the same state now feeds out approximately 150 steers each winter and has 270 Herefords in his own herd; before the war he fed none. Drainage and leveling of part of his feed-producing land, with the aid of district facilities, helped him accomplish this.

Back in California, in the Elkhorn Soil Conservation District, Tony Garcia increased the carrying capacity of his range from approximately one animal unit month to almost four, by proper stocking, fertilization and supplemental feeding on poor parts of his pasture.

Sweetclover pasture, seeded in conservation rotations, and pea stubble in the North Palouse

Sheepman Jimmy Richardson went in for fenced pastures to aid conservation management of his range, and to assist in herding and coyote control on the 20,000-acre McKenzie-Richardson ranch near La-Crosse, Wash. Here is seen a section of one 10-mile stretch of the 100 miles of fence being built.

(Washington) Soil Conservation District have been a boon to enterprising stockmen from nearby areas. In 1943, one outside sheep man alone took off 2,500 animal-unit months of sweetclover pasture, and more than 6,200 animal-unit months from 11,305 acres of pea stubble.

Returns to ranchers using the half-dozen land utilization project ranges in the Pacific Coast region during the past fiscal year tell a convincing story of the contribution to the war effort and profit for the operators arising from conservative range management. These projects total 360,116 acres in the region. On them, 505,480 pounds of beef, with a cash value of $75,922 were produced. Cost of management—including developments for future returns, such as seeding, fencing and stockwater improvements—ranged from 2-1/10 cents an acre to a high of 23 cents in one instance, with the next high 8-1/2 cents. Thus a 3-2/10-cent management cost on the 220,000-acre southeastern Idaho project returned war meat valued at $33,100. Improvement in the quality of permittees' herds was another result of the program.

In the central Oregon project, one lot of mixed-age steers gained more than 2-1/2 pounds a day for 63 days on a land utilization range consisting mostly of crested wheatgrass, which permittees in this area are seeding widely on their own lands. Chiefly because of improvement in project ranges, 11 percent more cattle were permitted on them in the spring of 1944 than in the same season of 1943.

Although range reseeding largely is limited in this region to special situations where it unquestionably is economically justifiable, considerable success has attended seeding abandoned cropland back to range grass, both within and outside of land utilization holdings. Thus Milt Branch in the Weiser River, Idaho, Soil Conservation District

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Irrigated Pastures Spurred by War

By HAROLD E. TOWER and FRANK B. HARPER

This good irrigated pasture is on the Joe Buerkili farm in Lewis County, near Chehalis, Wash. It uses a sprinkler system to supply water needed in this coastal area of high rainfall during the dry summer months.

War demand for meat and butter has brought improved pasture into its own as a desirable and profitable crop for irrigation farmers of the Pacific Coast region.

Butterfat produced at 8 cents a pound for feed cost on pasture instead of at 20 cents to cover hay and other feed outlays (as found by the Idaho State Extension Service), represents a sound investment of time, seed and land. One car of butter is the equivalent of 40 cars of hay, yet can be shipped at only 4½ percent the cost.

Furthermore, improved irrigated pastures stand high on the list of conservation land-use objectives in at least two-thirds of this westernmost region's approximately four score soil conservation districts. They are wanted from the dairy farms of western Washington, Oregon and California to the high mountain livestock ranches of eastern Nevada and Idaho. That is because well managed pastures provide at low cost high quality feed rich in essential vitamins and minerals, because good pasture sods are unexcelled in controlling erosion of sloping lands, because pasture grasses and legumes are adapted to soils that are too shallow, too wet or too alkaline for most cultivated crops, and because pasture sod is an ideal soil-improving rotation crop.

EDITOR'S NOTE.—The authors are regional chief of the agronomy division and head of the current information section, division of information, Soil Conservation Service, Portland, Ore.

Even in the coastal belts of Oregon and Washington, where rainfall averages 35 to 80 inches a year, and even more in some places, supplemental irrigation of pasture has proved its worth. More and more farmers are installing sprinkler irrigation systems. Five such systems were put in by South Tillamook Soil Conservation District dairy farmers, in Oregon, during 1944.

This seeming paradox is explained by the fact that summer rainfall is low west of the Cascade Mountains, where pasture production is abundant until June and then drops rapidly. Supplemental irrigation in June, July and August keeps the pastures growing and succulent during this critical period. Total yields are increased. Summer feeding costs are reduced. Management is simplified.

At the Western Washington Experiment Station, supplemental irrigation of ryegrass pastures was found to increase production 42 percent. The Oregon Experiment Station learned that the cost of an animal unit day of grazing on irrigated ladino pasture was 6.3 cents as compared with 7.8½ cents on summer Sudan grass pasture. Sam DeYoung in one year increased butterfat production from 390 pounds to 442 pounds per cow in one year by fertilizers, managed grazing and sprinkler irrigation. He is in the Montesano—Elma—Oakville Soils Conservation District, western Washington, where annual rainfall is between 90 and 100 inches.

In the interior irrigated valleys where diversified farming predominates, irrigated pastures long have been important in land use. In other areas of more specialized cropping, such pastures have occupied only a minor place. But war food demands have brought about some gratifying changes. When a magnesium plant was established at Las Vegas, Nev., for example, an immediately increased demand for dairy products arose. Farmers in the Moapa Valley Soil Conservation District, near Overton, are close to this market. They are increasing their production, among other ways, through development and improvement of irrigated pastures.

John Lewis is one of those who pioneered this program. He established a good irrigated grass-legume pasture in the fall of 1943. As he did not have enough of this pasture, however, for all the needs of his 40-cow dairy herd, Lewis rotated his 1944 grazing between the grass-legume pasture and annual winter barley planted likewise for pasture. He reported that when his cows were on the grass-legume pasture, the herd's milk output went up about 10 gallons a day as compared with production when on the barley pasture.

A seeded irrigated pasture on the I. W. Brunk farm in the Upper Thomes Creek Demonstration Project near Corning, Calif., brought milk production up 50 percent.

The implication is clear enough. The more of this kind of pasture a dairy farmer has, up to the limit of his needs, the more milk he is going to get and the more money he stands to make. Many irrigated sections of the West are handicapped by long distances to market, thus making it more profitable, except for certain specialty crops, to follow systems of farming that market crops as livestock products.

Irrigated pastures also are doing yeoman's service in the cattle- and sheep-raising West by balancing feed needs while conserving the soil. The Nevada Experiment Station has demonstrated these pastures to be the solution, when a stockman's irrigated hay lands yield feed enough to carry more livestock during the winter than his available range can carry safely during the summer. The irrigated pasture enables him to stretch his range to balance off his supplies, because he can graze it during early spring and late fall, before and after his stock is on the range.

Ranchers in the Mason Valley Soil Conservation District out of Yerington, Nev., find that seeded irrigated pastures produce 50 percent more feed than do native meadow pastures. G. Francesconi is one of them. He has 40 acres of district-planned grass-legume pasture that has been giving him 4 animal unit months of grazing and a ton and a half of hay an acre.

Even if higher production were not a primary object, as it is in these war days, the place that properly seeded and managed pastures have on irrigated farms has been demonstrated. Though such improved irrigating practices as growing cultivated row crops on the contour or across the slope, using appropriate lengths of water runs and the use of smaller heads of water, are invaluable in making possible safe cropping of much sloping irrigated land, there are limits to which such practices can be developed economically, and there are sloping fields of certain soil types on which even such measures cannot assure safe intensive cropping. Pasture and hay crops are the answer under such conditions.

Other land problems, including alkalinity, high or fluctuating water tables, and shallow soils likewise point to a potentially greater use of pastures on irrigated farms. Of the major cultivated crops, only sugarbeets, milo, sorghum and cotton com-

pare favorably with adapted pasture grasses and legumes in tolerance to rising salinity; and none of the cultivated crops, except rice, will stand periods of submergence or a high water table as well as will many pasture species. Therefore, where adequate drainage and alkali removal for growing rotation crops are difficult and costly, pasture appears the sounder and more profitable use of the land. Providing year-around ground cover, it reduces evaporation and thus prevents excess accumulation of salts on the surface, becoming important in reclaiming alkali lands.

Shallow-rooted, grass also grows on soils too shallow or stony to be tilled. Walter Mathiesen of Filer, Idaho, testified to this virtue of pasture grasses: "Irrigated pasture made me $100 per acre on shallow soils," he said, "as compared to 10 sacks of beans (valued at approximately $70) on similar soil in our adjoining field. I didn't get any erosion from irrigation on the pasture, and the only expense was for irrigating and going over it once with a mower to get rid of weeds and coarse grass."

In the Wood River Soil Conservation District, in southern Idaho, bringing new land under irrigation is a slow and costly task, as much of it is covered with surface rock and sagebrush that must be taken off before it can be prepared for cultivation. Particularly in view of war-time labor shortage, many district farmers are developing what they call "roughed-in pastures." In order to obtain some income from such Class III and IV lands while the better Class II land is being developed, mixtures of cheaper grasses are broadcast by hand; and the seeded areas are irrigated by sheet flooding or with deep corrugations or furrows three or four feet apart, often with waste water from crop fields. The roughed-in pastures are cleared and leveled later on, meanwhile yielding surprisingly large amounts of forage.

"Roughed-in" pastures are not, of course, a substitute for properly cleared and leveled irrigated pastureland. Land preparation pays as high dividends for pasture planting as for any other irrigated farming. The conventional irrigating method in the Pacific Coast region for pastures is with borders. In some localities, contour irrigated pastures have found favor, under conditions making this method less expensive than the straight border method for land leveling and preparation, and more convenient and effective to manage.

Pasture as a rotation crop is unexcelled for keeping up soil fertility, both the sod itself and the manure from grazing animals returning large amounts of organic matter to the soil, to be drawn upon in turn by cultivated crops. The pasture rotation experience of F. E. Roberts, Yakima County, Wash., dairyman and Extension demonstration farmer, have attracted wide attention. Not only are the pasture yields high on his farm near Sunnyside—3½ animal unit months to the acre for a 7-month grazing season as contrasted to the local average of only 1½—but other crops in the rotation have benefited proportionately: 40 tons of ensilage corn per acre, and a 4.4-ton yield on the first cutting of a new alfalfa-and-grass field, compared to the valley's yield for an entire season of only about 5 tons per acre.

More pastures in irrigated acres is but half the story: improved management is the other half. Pastures too often are limited to the poorest land and receive the least attention. Good irrigated pasture management practices favored by Pacific Coast farmers include use of improved, locally adapted seed mixtures, careful seedbed preparation, adequate land preparation and application of water at the right times and in the right amounts, fertilizing, weed control and grazing management.

Neglected pastures on irrigated farms of the West offer greater opportunities for management improvements than for any other crop. The high yields from the Roberts pasture, for example, are attributable to management—12 to 15 tons of manure applied to the acre before seeding, use of improved species, rotation grazing with clipping and harrowing after each grazing cycle, and biennial applications of 200 pounds of treble superphosphate per acre.

Fitting the method of irrigation to the field conditions and water supply, and land preparation consistent with the method of irrigation to be used, are essential to most efficient use of irrigation water. Changing from wild flooding to borders and corrugations on the Hiram Hanson farm in the Oneida Soil Conservation District in southeastern Idaho saved enough water to irrigate an additional 28 acres and cut the irrigating time from 114 to 72 hours. Slope of land, character of soil and subsoil, and available head of water, usually determine the system to use. High efficiencies of water use and high yields of pasture depend upon applying water in desired amounts and frequencies to meet plant and soil needs.

In a study of 205 farms in eastern Oregon, the Oregon Agricultural Experiment Station found that improved, mixed tame grass pastures produced 240 animal unit days of grazing to the acre,

Well-filled cows on irrigated pasture of the F. E. "Sandy" Roberts extension demonstration farm in Yakima County, Wash.

as compared with 152 from straight bluegrass pastures. Though cost of maintenance was higher for the mixed pastures, the increased yields resulted in a grazing cost of only $1.41 per head per month on the mixed pastures as against $1.56 on the bluegrass pastures.

There likewise is ample evidence of the value of pasture fertilization and proper irrigation. In one study, the Oregon station found that a 300-pound application of 16 percent superphosphate increased yields 75 percent. At the Caldwell, Idaho, Experiment Station, increasing the number of irrigations during the season from 5 to 7, and using a 12.5-load application of manure, boosted yields 58.7 percent. Liquid manure put on irrigated pasture at the Western Washington Experiment Station increased yields 27 percent. This station also found that rotation grazing increased pasture yields approximately 9 percent.

Clipping to control weeds that rob pasture plants of needed nutrients, and harrowing to scatter droppings that cause unpalatable patches of grass to develop, are other good management practices that increase carrying capacity.

IRRIGATED MOUNTAIN MEADOWS

(*Continued from page* 167)

sential, irrigated pastures have a definite function on most irrigated farms. The use of better mixtures of adapted species, of grasses and legumes, improved irrigation methods, and pasture management will allow the irrigated pasture program to expand, and at the same time provide favorable economic returns and assist in the maintenance of soil fertility.

TAKE CARE OF THE RANGE

(*Continued from page* 171)

had this to say concerning some 1,000 acres of such land he manages:

"Before seeding, an acre of this land wouldn't furnish enough pasture to pay the taxes. It took 15 acres to carry a cow and a calf for a month. Now, one acre does the job."

Good results in establishing profitable range forage also have been achieved on burned-over lands, whether on slash-burned timbered areas of south-central Washington or on burned sagebrush lands of southern Idaho. In the Underwood, Wash., district, for example, the grazing capacity of a 500-acre burned-over woodland range area was increased an estimated five times over that of identical unseeded burned land in 1943 as a result of 1942 fall seeding by the J. Neils Lumber Company with the cooperation of the Glenwood Cattle Association and district technicians.

By their works ye shall know them, truly may be said of conservation range-management practices. It is significant that at the 1944 meeting of the Washington State Cattlemen's Association, 3 of the 5 officers and 10 out of 11 resolutions committee members were soil conservation district supervisors.

The National Victory Garden Conference, Washington, D. C., recommended that continued and increased emphasis be placed on Victory gardens in 1945.

IRRIGATED PASTURES ARE A "MONEY CROP"

By J. G. HAMILTON

Grade Herefords "full fed" on this permanent irrigated pasture compare favorably with best pen-fattened stock. They received no supplementary ration.

Planting irrigated pastures on $200-an-acre land is more profitable than growing cotton and other "cash" crops, according to Willard Welker, of Safford, Ariz. Mr. Welker finds that on the present livestock market the income from his pastures exceeds $100 per acre—more than from the rest of his land after labor costs are deducted from gross returns.

Welker is particularly pleased with the success of his new "crop" because it was planted on land that was in cotton and corn for 13 straight years and had lost much of its fertility.

The owner of 547 acres of cultivated land in the Gila Valley Soil Conservation District, Welker has had 30 years experience in the production of sugar beet seed, barley, cotton, alfalfa, corn, grain sorghums, and other crops.

Cotton has for several years been his most important source of cash, but he has always been alert for any new crop that could be used to advantage in his farming system. Although he had grown annual pastures to supplement fall and spring grazing on small grains, he had not considered it practical to plant perennial mixed grass-legume pastures on high-priced irrigated farmland.

The pastures were introduced to the general area in 1940 when Mervin L. Wallace, area agronomist for the Soil Conservation Service, interested a dairyman and another livestock farmer near Duncan, Ariz., in seeding experimental tracts. These grass-legume plantings were highly successful, and in 1941, when the Gila Valley Soil Conservation District was organized and Wallace was made district conservationist, he used them to convince two Safford Valley farmers that irrigated pastures should be equally profitable in their locality.

These demonstration plantings also were successful, and 14 additional pastures with a total area of 218 acres were planted in 1942. A total of 1,253 additional acres was seeded by 49 farmers in 1943, and 51 farmers are planting 950 acres this year.

Although these plantings may not appear impressive to persons thinking in terms of Midwestern agriculture, they represent more than 7-1/2 percent of the total irrigated acreage in the Safford Valley—a sizable percentage for a new crop within three years after its introduction.

At first Mr. Welker was content to study the operations of his neighbors before adopting a perennial pasture program on his own farm. He

EDITOR'S NOTE.—The author is regional chief of the agronomy division, Soil Conservation Service, Albuquerque, N. M.

knew what to expect from proved cash crops, hay crops and annual pastures, and he did not care to introduce a new crop blindly.

By 1943, Welker was convinced that mixed grass-legume pastures could compete with so-called cash crops, as well as with hay and pasture. He was not convinced, however, that the standard mixture being used in the Valley was the best possible one. District Conservationist Wallace and County Agent Steve Owens encouraged him in his quest for added information, so in 1943, he planted 22-1/2 acres to 11 different mixtures, including the standard mixture used by most of his neighbors, and a commercial mixture that was being recommended. The Soil Conservation Service nursery and State Extension Service cooperated in this trial planting and suggested 9 of the mixtures.

Temporary pastures of barley and Sudan grass were used to supplement the mixed grass-legume pasture plantings. In late November, 1943, Welker bought 146 head of grade Hereford calves. Their average weight at time of purchase was 412 pounds. Up to September, 1944, the different pasture mixtures had provided 27,605 days grazing. Since the average weight of animals already sold and those remaining on pasture was, approximately 800 pounds, it is estimated that the combined mixtures produced 1.99 animal units grazing the first year (unit based on 1,000 pounds weight).

In June, Welker sold 37 head of cattle fattened on the pasture at 14 cents for the steers and 13 cents for the heifers. It is interesting to note that the top price paid for pen-fattened cattle in Los Angeles that day was $14.65 per cwt. The animals in Mr. Welker's consignment received no fattening ration, other than the pasture mixture. The remaining animals were fed a supplementary ration of grain beginning the first part of November, 1944.

The 11 study plots were divided into four separate fields, but only two fields were grazed regularly. Mr. Welker discontinued using the other two, because they had alfalfa as one of the legumes in the mixture, and he lost two of his animals from bloat after they were placed in them. Two others died from unknown causes.

Asked for comments on the different mixtures and some "do's" and "don't's" that he would like to have passed on to inexperienced pasture operators, Welker said that it was still too early to give a definite answer on the mixtures, but that a few facts had been established, at least to his satisfaction.

Level land and a firm, well-prepared seedbed are essential to growth of good irrigated grass-legume pastures. This farmer makes shallow furrows with cultipacker in preparation for broadcasting seed mixture. The seed will be covered with same implement.

Where perennial pastures are desired, he would recommend that no strong-growing annual grass species be included in the mixture. He also would hold down the seeding rate of perennial rye grass because of its vigorous competitive growth habits that retard the establishment of the slower-growing, longer-lived perennials that are not so vigorous during the first few months of their growth. He can see no need for the large number of species that ordinarily are recommended in pasture mixtures, because he has observed that many of these will disappear within a year or two, or their growth will be so retarded that they have little permanent value in the mixture.

Since several of his animals bloated while they were grazing on the pastures containing alfalfa, notwithstanding close supervision, he prefers to leave alfalfa out of his pasture mixtures. The cattle grazing on the mixtures containing sweet clover, alsike clover, ladino clover, button or bur clover were not affected. He says that he is convinced that the bloat hazards of alfalfa in the Safford

Valley are far greater than those in the Salt River and Yuma valleys in Arizona and the Imperial Valley in California, where alfalfa is grazed successfully. He also believes that alfalfa in the mixtures retards the establishment and growth of most of the grasses, whereas the other legumes appear to improve the growth—particularly when they do not constitute more than one-half of the volume.

Among important "don't's" he would say, do not overgraze. More feed and more beef will be produced on an undergrazed pasture than on one that is overgrazed. Use enough livestock to graze the pasture off, and then rotate. Do not graze pastures when the ground is wet—this is particularly important during the first three or four years of the pasture's life or until a good strong sod cover has been formed.

Welker's practice has been to put his livestock "on" five days and "off" seven days. Two pastures are the minimum required for good management but three or more are preferable. If the pasture is too large for the number of livestock to graze properly during the period, it should either be reduced in size, the number of livestock should be increased, or mowing should be done to prevent patch grazing. However, Welker considers mowing to be a poor substitute for good management. Management should be such that patch grazing will not be a problem.

He advocates the same careful land leveling and seedbed preparation that is required for alfalfa. In other words, he wants the elimination of high and low spots, and a well-prepared, compact seedbed. He cautions against planting pasture seed too deep, and suggests a planting depth of from one-fourth to one-half inch.

Welker prefers to irrigate by the border method, using corrugations or shallow furrows. The latter are particularly desirable if the soil tends to be "tight." The corrugations should be spaced so that the water will "sub" through in a reasonable time with a minimum loss through deep percolation. For his soil, he finds 16 inches a proper spacing. Length of irrigation runs, within reasonable limits, should be determined by the cost or scarcity of irrigation water, he believes.

He says that water moves through a properly managed grass-legume cover much more slowly than through an alfalfa field, and where the scarcity of irrigation water or its high cost is a problem, he suggests that the runs be reduced from one-third to one-half the length of those used for alfalfa, and that the borders be high enough to permit trampling down by livestock and still be capable of holding the irrigation "head." For his soil type, irrigation every two weeks during the grazing season keeps the pasture in thrifty growing condition.

Mr. Welker also observes that the irrigated mixed grass-legume pasture has a lower insurance risk than any other crop when it comes to damage by hail, cloudbursts, flooding, soil erosion, and insect and disease pests. He is convinced that irrigated perennial pasture plantings not only will be increased throughout the irrigated portions of the country, but that their value will be increased as we learn more about the sustained behavior of the different grass and legume species under various climatic and soil conditions.

PLANT VIGOR AND RANGE PRODUCTION

By J. L. LANTOW

Merely to be alive is important, but to have abundant health is still more important. This is as true of plants as of animals. Certainly a healthy, vigorous plant or animal has the advantage when competing with an unhealthy one, and who would question which would provide the more forage, beef, mutton, or milk?

Forage plants can live without livestock, but livestock cannot live without forage plants. Too often it is the case that the forage plants cannot live, or live only in a weakened condition, because of their treatment by livestock. Actually they both could be a great help to each other. If this could be, why not have it so?

The care of a range demands frequent diagnosis of conditions on range or pasture. The good diagnostician sizes up the situation correctly, and if he doesn't know the treatment he can look in the book to see what to do. Doctor and range operator have similar problems which call for both knowledge and experience. There is this difference: people who do not feel well go to the doctor and tell their story; ranch operator must go to the range himself to discover what is wrong. There is none so blind as he who does not know how to see. To see the things that are happening on the range, sight alone is not enough. You must know how to

EDITOR'S NOTE. — The author is regional chief of the range division, Soil Conservation Service, Albuquerque, N. M.

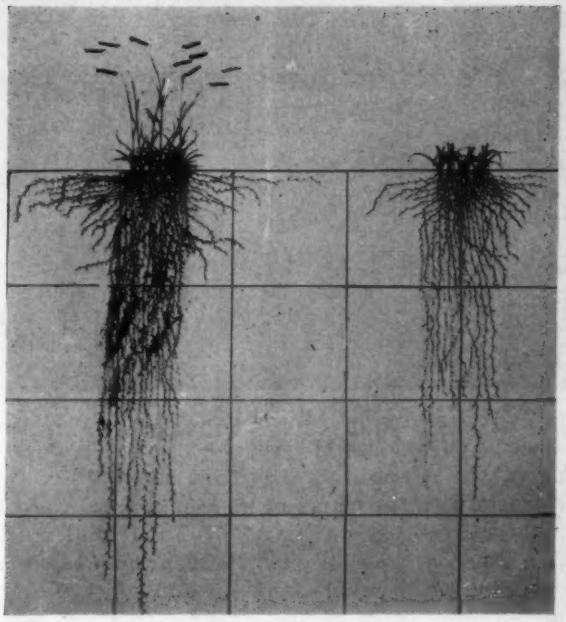
read the story of the range after you see it. Our ranges are so much Chinese to too many range advisors and operators.

Health and vigor determine plant competition and forage production.

Vigor in forage plants is almost synonymous with health. It is the driving force which governs poor production or good production; and decides whether certain forage plants can compete favorably or unfavorably with less desirable ones. Vigor certainly is the key to plant succession. If vigor is so important, how do we recognize it, and what do we do to build it up? A few simple guides help in recognizing vigor.

1. Large stem and leaf growth, speaking comparatively.
2. For the bunch-type grasses, a bunch-type growth at the base of the plant or tuft, with no undue crowding.

Successive stages in loss of vigor are shown in these blue grama grass plants. Compare the amount of forage produced by the plant at right with that of the two at left.



Repeated close grazing during growing season shortened root system of plant on right. Plant on left gets more water and food, and produces more than plant at right. Since it is healthy, it will be able to compete well with poor species that try to invade the range.

3. Good volume growth or good height in average or favorable rainfall years.
4. Early spring growth, if moisture is available.
5. A well-developed and deep-root system.

It may be well at this point to inject the reminder that plants in a state of high vigor may die, or a portion of the tuft may die, from lack of moisture. If a portion of the tuft dies, due to lack of moisture, but the plant has not been penalized by use, it is quite likely that when there again is enough moisture and a suitable temperature prevails, the plant will grow quite luxuriantly, indicating that its loss of vigor was only temporary. Such plants retain an adequate root system and have food stored in the portion of the crown or roots that remains alive. If enough density is lost, however, other plants can invade. In some types of plants too great a density results from close grazing. Some bunch-type species then will take on a sod-forming aspect. When this occurs, vigor is lower than it should be.

There is a great deal of difference in results when the plant is low in vigor. A weakened plant lacks the food reserve and the root system to respond to rainfall or recover after a drought. The

Five years ago these two pastures looked alike. Proper grazing since then on tract to left of fence made the difference. Grass on that side has regained its vigor and almost eliminated snake weed.

plant starts to grow, but its low vitality does not allow it to produce the volume of the vigorous plant. The vigorous plant has the root system to compete with the plants of its kind and with any other species that may be at hand. For some reason, our most desirable plants ordinarily dominate over the less desirable forage plants, or even the undesirable forage plants, provided they are not penalized by misuse.

Let there be no mistake. For the most part the plants that we see are present because we gave them a chance in one way or another. The whole story, then, is that the healthy, vigorous plant is able to compete with other species and produce more than the less vigorous plant. The desirable grasses, if vigorous, prevent the invasion of the plants we do not want.

Training of people to use tools in performing the operation for which they were designed is highly important. Too often, however, the tools become all important, and the operation only secondary. On the range, both novice and veteran need to put into effect only a few basic management practices to get result. Science reveals to us that vigor of plants is affected adversely by:

1. Too *early* use.
2. Too *frequent* use.
3. Too *close* use.

If the best vigor and the highest plant production are sought all *three* of the above dangers must be avoided. Don't fool yourself, you can't ignore them and bring in high production. It's as important to have the right idea about plant growth as to have a perfect range management plan.

Project your management of the range on the feed available rather than upon what you think you may get. Then, there'll be less worry about when it's going to rain.

IRRIGATED PASTURES SOLVE BINDWEED PROBLEM

By PAUL G. MOORE

Members of the Minersville Soil Conservation District have discovered a simple cure for two of the worst plagues farmers have to fight—alfalfa wilt and bindweed infestation. It is not only a simple cure, but a highly profitable one. The cure is grass.

When the Minersville district—the first soil conservation district in Utah and in the Southwest region—was organized back in 1938, the livestock forage problem was critical. Many fields of alfalfa had a total yield of less than 10 tons to the acre from the time they were planted until the wilt killed the stand completely, usually in three or four years. As the alfalfa died out, the morning glories came in. A number of farms were abandoned because of the heavy cultivation expense and low yields caused by the infestation.

The competition of the weed also made it difficult to grow small grains or row crops. Clean cultivation, in conjunction with the use of chemicals such as sodium chlorate and carbon bisulphide, did not offer a solution to the problem, because of the great amount of effort and expense involved in eradicating large and well-established bindweed stands, and the soil sterility that usually follows such treatment.

EDITOR'S NOTE.—The author is in the current information section, Soil Conservation Service, Albuquerque, N. M.

Experimental plantings of mixtures of grass and alfalfa for hay, and of irrigated pasture grasses were begun at once, under the guidance of Soil Conservation Service technicians working with the district. The experience of Darwin Marshall is typical of that of farmers who tried the mixed hay idea as an answer to their problems.

Mr. Marshall bought an abandoned farm from the state a few years ago. The former owner had given it up as worthless, due to the heavy infestation of wild morning glory, and low fertility. When he began cultivating it again, the yield of alfalfa was about one ton per acre, and other crop yields were correspondingly low.

Knowing that he was playing a losing game against the bindweed and poor soil with both his alfalfa and his row crops, Mr. Marshall decided to try the grass-alfalfa farming idea. Where he had been attempting unsuccessfully to grow corn, he planted a mixture of alfalfa, orchard grass, smooth brome, and crested wheatgrass.

The land was fall-plowed to a depth of from 12 to 14 inches. It was harrowed, floated, and seeded in a firm seed bed. That didn't daunt the morning glories, of course—they came up again, and were doing fine. But, gradually, the grass began to turn the tables on the weed. Instead of being choked out itself, it began choking out the "glories."

Mr. Marshall's plantings are four years old. Instead of getting one-ton alfalfa yields, he has been cutting from five to six tons of mixed hay for the last three years, and the crop is increasing, instead of decreasing, as it had when alfalfa was planted alone.

The bacterial wilt has been killing out alfalfa all this time, of course, but as the alfalfa stand has decreased it has been replaced by grass instead of bindweed. There are still some vines in the field, but they are losing out in the competition.

This hay is helping to build up Mr. Marshall's farm indirectly in another way. He is adding to the fertility of that poor soil by applying about 10 tons of manure per acre.

Pleased with the success of his mixed-hay planting experiment, Mr. Marshall seeded an additional five acres of alfalfa and grasses last year and obtained an excellent stand.

The farmers in the district are agreed that it is inadvisable to include crested wheatgrass in the mixtures, due to its poor yield under local conditions. They also recommend a seeding of 30 pounds per acre instead of the 22 pounds as suggested for land that is free of weed infestation.

The methods of seed-bed preparation that they have been using depends, of course, on the previous crop. Results, they say, are better when a cultivated crop such as corn is planted a year or two preceding the seeding of the land to grass. This weakens or destroys "weed" grasses that otherwise might compete with the new crop.

The fields to be planted are generally plowed in the fall, and harrowed the following spring until a fine, firm seedbed is obtained. Although some farmers use a hand broadcaster to seed grass, drilling usually has produced more satisfactory results, since it permits a better distribution of seed and covers it at a uniform depth for quicker and more even germination. Grass seed must not be planted too deep—about one-fourth inch is the correct depth.

Irrigated pastures like this enable Utah ranchers to balance feed budgets, and Utah dairymen to boost State's milk cow population from 105,000 in 1941 to 121,000 in 1944. Members of Minersville Soil Conservation District find that permanent pastures and mixed hay plantings are important, also, for other reasons. Grass ended their bindweed, alfalfa wilt and erosion worries.

Spring seeding should be done when the ground has warmed enough to permit maximum germination. It should be completed early enough during the summer to permit at least two irrigations, according to Stanley McKnight, one of the Minersville district supervisors.

The use of small, narrow furrows for irrigating, with a 22-inch interval between them is favored by most members of the district. A 2- or 3-inch application of water per acre is suggested.

In planning the irrigation system, the type and depth of soil, slope of land, time of plowing, and density of grass stand must be considered. For a sandy loam with a slope of one percent an a thick stand of pasture grasses, the runs should not exceed 300 feet, and the width of strips, 50 feet, if about 3 cubic feet per second of water are used. In heavy soil, runs should not be longer than 600 feet, and the width of strips 100 feet, for the same amount of water. However, the exact width of strip and length of run must be determined by trial and use of a moisture probe to determine water penetration.

An added advantage of grass farming in the Minersville area is that it is making it possible to irrigate safely much of the sloping land that was subject to severe erosion under other types of cropping, and was bringing in little financial return.

Suitable grass mixtures vary greatly in Utah according to the climate, altitude, and soil type, and farmers should consult their county agent or district conservationist before buying seed.

Proper maintenance of the pasture is just as important as getting a good "stand." Droppings should be scattered with a brush drag or harrow early in the spring, and in the summer following the rains to prevent killing spots of grass; this will usually mean harrowing three or four times. Yearly applications of from 5 to 10 tons of barnyard manure and 100 pounds of treble superphosphate per acre have proved very beneficial.

The pasture should be clipped as often as necessary to get rid of weeds, and to stimulate new growth in clumps of grass.

Cows should not be turned into the pastures until the growth of grass reaches four to five inches, and then only when the soil is dry enough to be firm. Rotation between two or three pastures will result in a higher production of nutritious forage, and healthier stands of grass.

One thing that some farmers tend to forget is that over-grazing of an irrigated pasture is just as disastrous as overgrazing of the native range.

CRESTED WHEATGRASS HELPS CONTROL BINDWEED

By WILKIE COLLINS, Jr.

EDITOR'S NOTE: Research by the Department on the control and eradication of bindweed bears out the experiences of farmers related below. Some grasses and mixtures of grasses suppress the growth of bindweed. Experiments have shown, however, that bindweed seed hold over in the soil for as long as 30 years, and even the puny growth in pasture mixtures produces viable seed that makes a return of the land to cultivation a hazardous venture.

Creeping jenny . . . field bindweed . . . wild morning glory!

Those are some of its better known common names. But descriptions of this weed and what it does to crops provokes more sultry language than almost any pest which plagues farmers. Thomas Ptak, near Dante, South Dakota, calls it "the worst bandit ever to visit the State."

Not a local problem, bindweed costs the farmers and ranchers in the Northern Great Plains several million dollars a year through reductions in crop yields and the costs of attempting to control it. It is present in every county in North and South Dakota, also widespread in Kansas and Nebraska—especially severe in the eastern half, and is invading Montana and Wyoming.

A persistent perennial vine, bindweed uses moisture needed for the production of crops and strangles plants growing in the same land with it. When moisture is plentiful, bindweed reduces yields sharply; in more nearly normal years it will choke off crops entirely in the less humid areas.

Treatment with chemicals or intensive cultivation for a minimum period of three years are the better known methods of controlling bindweed. Both methods are expensive, and in addition take the treated areas virtually out of production for some time. There is definitely an investment relationship between the crop producing capabilities of land and the expense of bindweed control.

But there is a brighter side. Hated as it is, bindweed is not the least influence in getting good land use in extensive areas in the less humid portions of the Northern Great Plains. It has infested thousands of acres whose crop production will not support the expense of controlling it chemically or through intensive cultivation.

This land is being seeded to crested wheatgrass —much of it has been classed by conservationists as best suited for grass, anyway—with the result that it is being brought into higher production. Actually some of the fields had been abandoned for cultivated crops, principally because of bindweed.

David Peterson, near Kadoka, cooperating with the Badlands-Fall River land utilization project, gives a graphic description of what bindweed does to crops in the less humid areas. He was one of the first to plant crested wheatgrass in infested fields.

"The seeding was made in the fall of 1937 in a 40-acre field," Peterson said, "In 1935, the corn there got only about 5 inches high before it was choked out by the bindweed. But corn in an adjoining field, where there was no bindweed, yielded 20 bushels an acre."

An early growing plant, crested wheatgrass attains considerable height before bindweed starts its year's growth. It also uses the spring moisture before the bindweed gets going. Under the double handicap, without adequate sunlight and robbed of much of the moisture supply and available plant food, the bindweed does poorly indeed.

"We seeded the field in strips," Peterson explained. "I didn't think that the grass would come up because the bindweed was so thick. It showed up in the strips the first year, but it was three years before it started to spread between the strips and another three years for the grass to cover the whole space between."

Now, at the end of 8 years, only occasional bindweed plants are found in the old strips, and they are far from thrifty. In between the seeded strips the bindweed is suppressed but more plants are to be found.

Peterson estimates that crested wheatgrass seeded in strips takes twice as long to suppress bindweed as when the whole field is seeded. His estimate is based on some experience.

"In 1935, 1936 and 1937," he said, "we had a half-acre garden near the house. We tried to hoe it every week, but the bindweed took over. In the fall of 1937, I seeded crested wheatgrass. It grew so well that in 1942, 1943 and 1944 I cut an average of a ton of hay per year from that half-acre. There is only an occasional, very spindly bindweed plant there now."

Peterson has never mowed the 40-acre field, using it for pasture entirely. It's good pasture, he said. Nevertheless, he estimated that he could cut a ton to a ton and a half of hay per acre there in 1944 if he had wished.

Investigations by Edgar A. Joy of Brookings, S. D., a Soil Conservation Service research employe cooperating with the South Dakota experiment station, support the experiences of farmers in general, and in addition seem to establish the importance of crested wheatgrass' early use of moisture in suppressing bindweed.

This is the 50-acre field "solidly infested with bindweed" which E. J. Rubendahl seeded to crested wheatgrass in the fall of 1941. It is near Artesian, S. D. In 1944 it produced a crested wheatgrass seed crop of 200 pounds an acre. One small patch of bindweed is seen in the foreground, but the grass has pretty well suppressed the weed throughout the whole field. The photograph shows that the bindweed plants didn't do so well in competition with crested wheatgrass.

Last year in a field test, after a very wet spring with abnormally high rainfall, Joy reports, he found the soil in crested wheatgrass strips rather dry below the one-foot level. On areas not in grass, the soil was wet for a depth in excess of three feet. The probability is that the crested wheatgrass used up the moisture before the bindweed could make sufficient growth to compete.

Near Phillips, S. D., Joy reports, is one field of crested wheatgrass where bindweed is well under control but the infestation on the adjacent roadside is heavy. And on both the Robert Roth and G. F. Buel farms near Rapid City, S. D., a few bindweed plants are still present in the drainageways even though the crested wheatgrass seems to have eliminated bindweed plants from the rest of the field.

The presence of bindweed has had no apparent effect on the yields of crested wheatgrass either for hay, seed or pasture, probably because the bindweed is not in a position to compete with so early a growing plant as crested wheatgrass.

Consequently, many thousands of acres of land have been restored to production often greater than when it was in crops even without bindweed competition. Fields which had become so heavily infested as to be abandoned are being brought into production which can be computed in terms of many thousands of pounds of beef, mutton and wool.

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